ETOM TECHNOLOGIES, INC.
(FORMERLY OPTEX COMMUNICATIONS, INC.)

Packing More Data Into Optical Data-Storage Disks

Optical data-storage devices, typically CD-ROMs (compact disk, read-only memory), have taken the desktop computer market by storm, becoming a standard part of almost every computer sold. Just five years ago they were included in such equipment only by special order. Now, millions of these devices are manufactured and installed every year.

COMPOSITE PERFORMANCE SCORE
(based on a four star rating)

No Stars

A Rewritable, Higher-Capacity Compact Disk

Optical disks hold much more data than conventional magnetic hard or floppy disks, the alternative data-storage technology. The optical devices employ the same technology used with music CDs: a laser stores the data by pitting the disk surface in a pattern that can be read by another laser. When it was introduced, a conventional plastic CD-ROM could hold 650 megabytes of data, whereas typical hard disks then held fewer than 50 megabytes. Optical disks, however, could be written only once, and the drive mechanism was much slower than magnetic hard disk drives.

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New technology is addressing both deficiencies. Optical-disk-drive speeds have increased substantially, and several techniques for enabling the device to write new data are now commercially available. This project with ETOM Technologies, a small start-up company, developed technology that greatly increases the amount of data that can be stored on optical disks.

Large Jump in Storage Capacity

The ETOM technology uses a glass, rather than plastic, disk onto which is laid a light-sensitive substrate that can be written and read by the lasers in conventional CD-ROM drives. The core technology is called electron-trapping optical memory (ETOM). Data are written to the substrate by a low-power laser tuned to a specific frequency. The laser light raises individual electrons in the substrate to an elevated energy level, where they are trapped indefinitely. The data are read by a second laser, which releases the trapped electrons to return to their lower energy state, emitting a light signal in the process.

In addition to being a write-and-read device, the ETOM disk is able to store data at multiple energy levels, giving it the ability to use “multiple-ary” digits, as opposed to the binary digits (having two energy levels) used in conventional magnetic data storage. This capability greatly increases the amount of data that can be placed on the disk. For example, a byte (group of eight digits) using binary digits can store 256 different numbers. A byte using a polynary digit with three energy levels, however, can store 6,561 numbers. Thus, the use of just three different energy levels instead of two increases the disk’s storage capacity more than 25 times.

Unforeseen Obstacles Block Commercialization

The company planned to manufacture and sell ETOM-based digital video recording products if the technology could be successfully developed. The technology was developed. But barriers arose that made it impossible to offer a cost-effective video CD-ROM. The company needed a green laser, but a commercial supply of them did not materialize as expected. Nor did the market materialize for a video-on-demand device, which would have used the video CD-ROM to temporarily store movies and other videos downloaded by viewer request from a cable-TV company.

After attempting to develop additional technologies to enable it to survive, ETOM ran into severe financial

PROJECT HIGHLIGHTS

Project:

capable of recording digital video information on an ETOM (electron trapping optical memory) optical disk, a development that could substantially reduce the cost of storing digital information.

Duration: 2/15/1993 — 12/31/1994
ATP Number: 92-01-0122

Funding (in thousands):

ATP	$1,433	56%
Company	$1,118	44%
Total	$2,551	

Accomplishments:

ETOM demonstrated the ability to store data in a radically new optical data-storage mode. The company completed header pattern definition, mask fabrication, and software for reading and writing M-ary (multiple-ary, as opposed to binary) data and developed specialized test equipment. It also:

- received 12 patents for technologies related to the ATP project:

"Partial Response Coding for a Multilevel Optical Recording Channel"
(No. 5,537,382: filed 11/22/1994, granted 7/16/1996),
"M=7 (3,7) Runlength Limited Code for Multilevel Data"
(No. 5,657,014: filed 5/12/1995, granted 8/12/1997),
"M=5 (0,2) Runlength Limited Code for Multilevel Data"
(No. 5,659,310: filed 5/12/1995, granted 8/19/1997),
"M=6 (2,4) Runlength Limited Code for Multilevel Data"
(No. 5,659,311: filed 5/12/1995, granted 8/19/1997),
"M=10 (3,6) Runlength Limited Code for Multilevel Data"
(No. 5,663,722: filed 5/12/1995, granted 9/2/1997),
"M=7 (1,3) Runlength Limited Code for Multilevel Data"
(No. 5,663,723: filed 5/12/1995, granted 9/2/1997),
"M=6 (3,6) Runlength Limited Code for Multilevel Data"
(No. 5,668,546: filed 5/12/1995, granted 9/16/1997),
"M=5 (3,7) Runlength Limited Code for Multilevel Data"
(No. 5,670,956: filed 5/12/1995, granted 9/23/1997),
"M=5 (4,11) Runlength Limited Code for Multilevel Data"
(No. 5,675,330: filed 5/12/1995, granted 10/7/1997),
"M=6 (3,8) Runlength Limited Code for Multilevel Data"
(No. 5,680,128: filed 5/12/1995, granted 10/21/1997),
"M=4 (1,2) Runlength Limited Code for Multilevel Data"
(No. 5,682,154: filed 5/12/1995, granted 10/28/1997),
and
"M=6 (4,11) Runlength Limited Code for Multilevel Data"
(No. 5,682,155: filed 5/12/1995, granted 10/28/1997);

- applied for 14 additional patents for technologies related to the ATP project;

- prepared several technical papers for publication or presentation at professional conferences; and

- entered into preliminary negotiations with potential users of its patented M-ary coding algorithms.

Citations by Others of Project's Patents: **See Figure 1.**

Commercialization Status:

Commercialization of the original data storage device employing the ATP-funded technology faltered because not all necessary technical components were available for the system, and the expected market did not materialize. The company encountered severe financial problems in late 1997 and declared bankruptcy in March 1998.

Outlook:

Although ETOM's recent bankruptcy precludes its commercialization of this technology, substantial knowledge was gained, as reflected in the patent applications and grants. The possibility exists that other companies will license and commercialize the technology.

Number of Employees: 30 at project start, 3 at the end of 1997

Composite Performance Score: No Stars

Company:

ETOM Technologies, Inc.
(formerly Optex Communications, Inc.)
2 Research Court
Rockville, MD 20850

.. . . ceased operations in January 1998 and filed for bankruptcy two months later.

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problems in late 1997. Private investors in ETOM decided it could not continue to operate without the business from a partnership to commercialize one of these technologies — a deal that ultimately fell through — so they decided to close ETOM. It ceased operations in January 1998 and filed for bankruptcy two months later.

ATP Critical to Developing New Technology

ETOM reports that if it had not received the $1.4 million ATP award, it could not have performed the research and probably would not have survived as a company

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long enough to conduct the research. It encountered difficulties in bringing to market an optical disk device incorporating its new technology. Even though the company is no longer in business, the new approaches developed in this ATP project may eventually be picked up and used by some other company.

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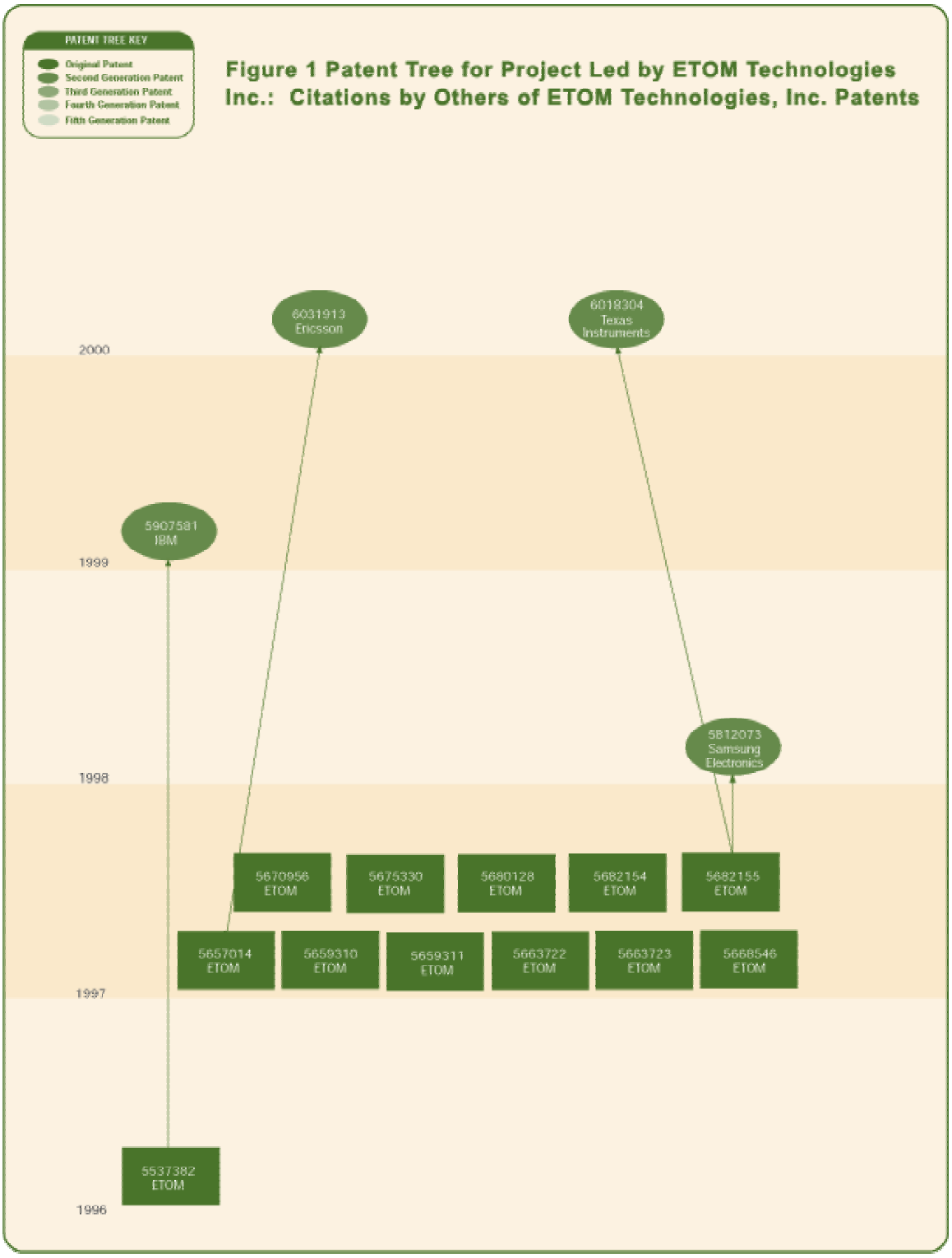

This status report was written during 1997-1998 and published in March 1999.